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(12) UK Patent Application (19) GB (11) 2 185 786 (13) A

(43) Application published 29 Jul 1987

(21) Application No 8600286

(22) Date of filing 7 Jan 1986

(51) INT CL⁴
F03D 7/06

(52) Domestic classification (Edition I):
F1T W1B2 W2A

(56) Documents cited
GB 1539566 EP A2 0045264 WO A1 83/01279
GB 0733812 WO A1 80/00473 US 3986786

(58) Field of search
F1T
Selected US specifications from IPC sub-class F03D

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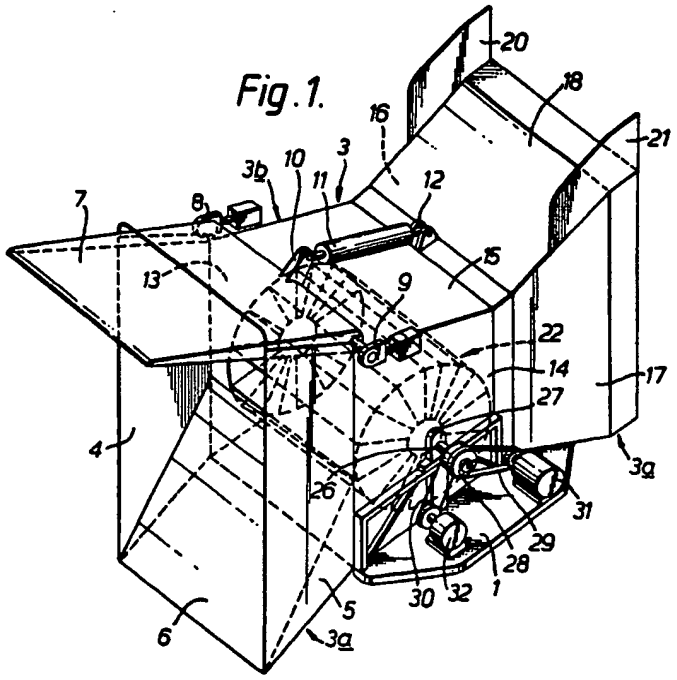
(54) Wind powered machine

(57) The machine comprises a rotatable housing 3 having an inlet portion 3*a* of reducing cross section, an intermediate portion 3*b* containing a rotor 22, and an outlet portion 3*c* of increasing cross section. The roof of the inlet portion comprises an adjustable flap 7 for controlling the air flow through the housing. The rotor 22 is preferably mounted horizontally and is of generally cylindrical form. The rotor comprises a number of blades extending radially from a central core and joining end cheeks (25, Fig. 2) to form enclosed spaces. The rotor is coupled to power take-off means such as electric generators 31, 32 which are successively brought into operation as the rotor speed increases. The device may be mounted on a turntable 2 to permit rotation into the wind.

Fig.1.



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The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

Fig. 1.

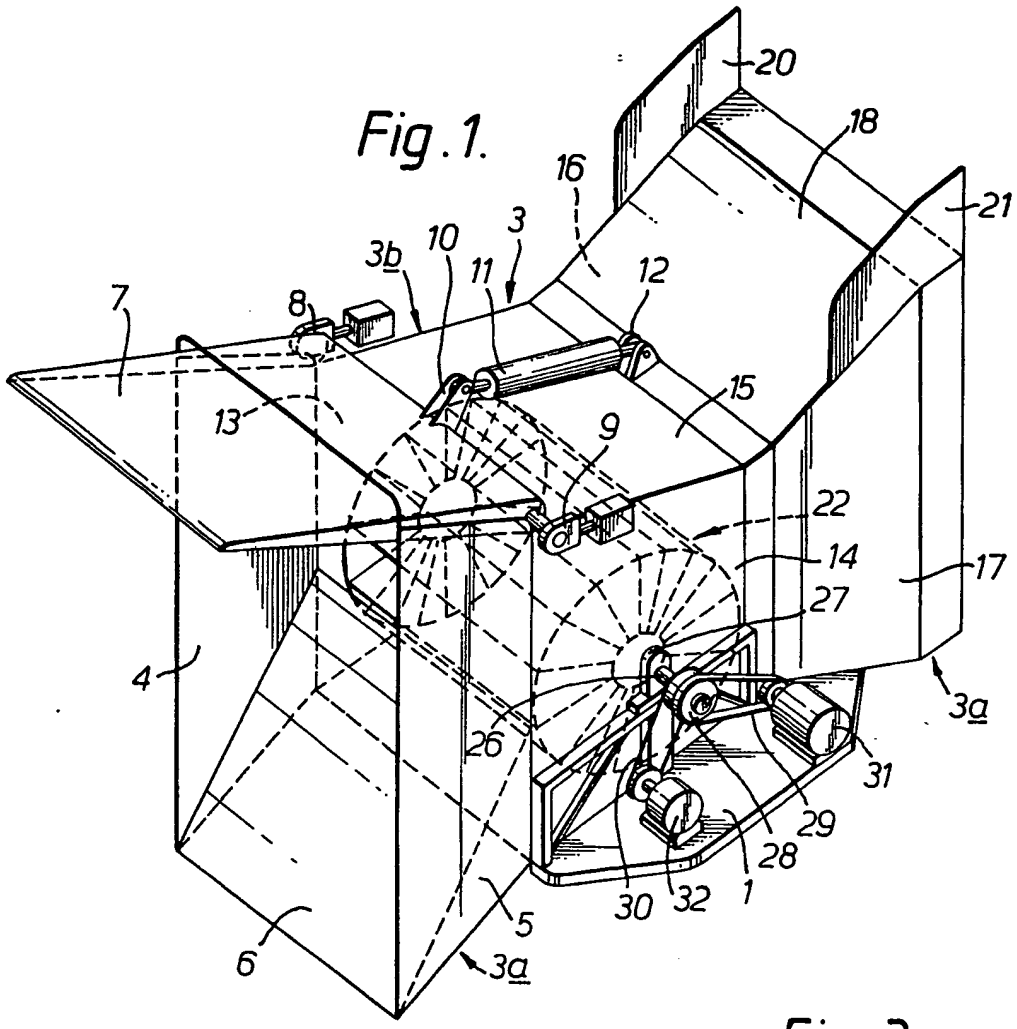
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Fig. 3.

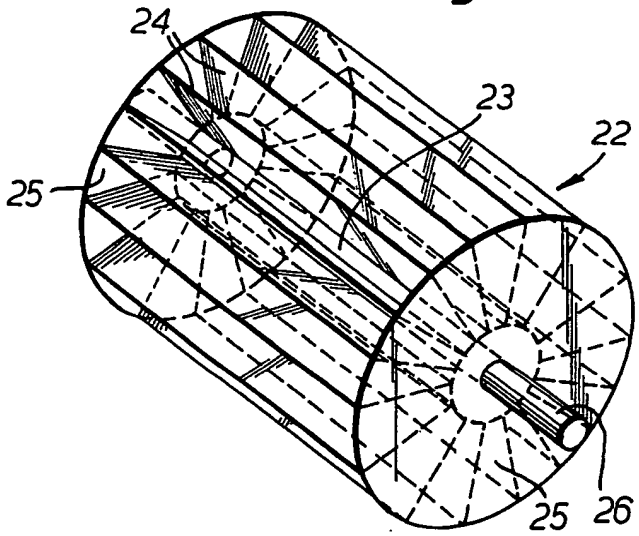
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Fig.2.

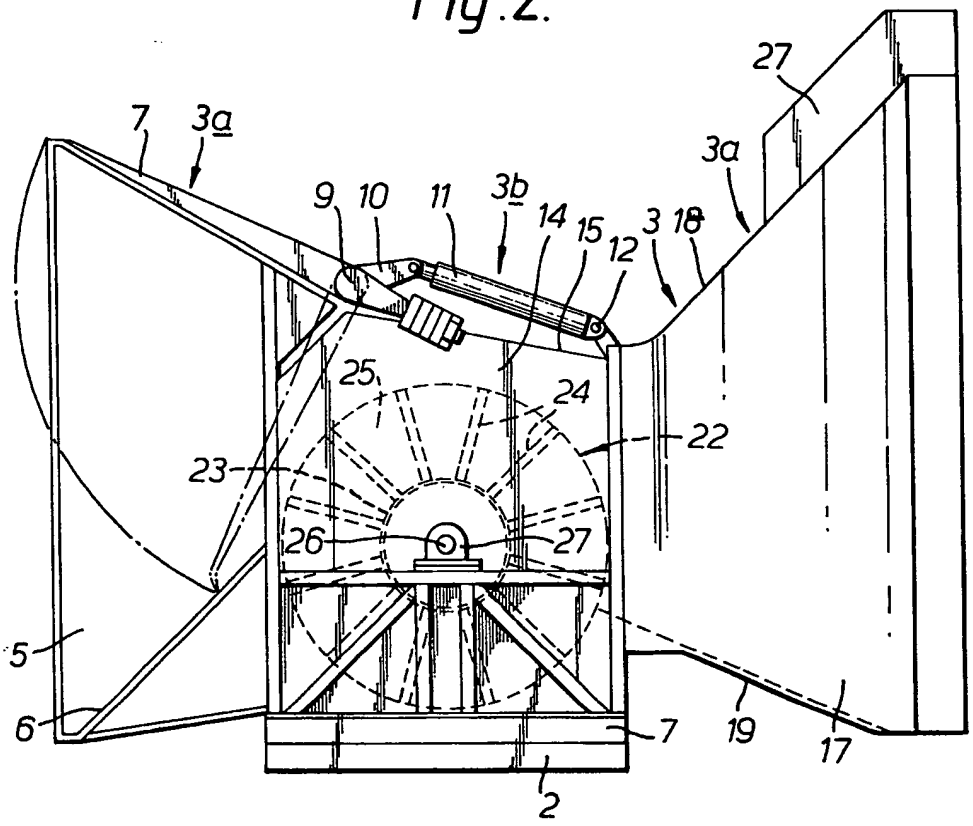
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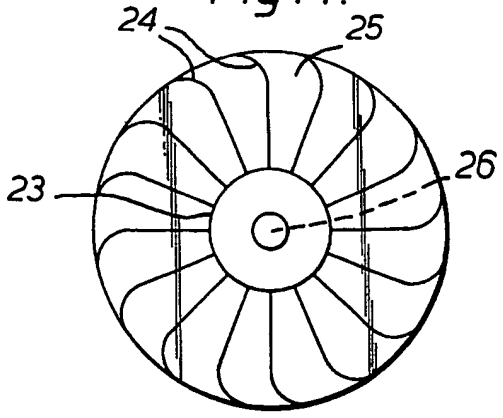
Fig.4.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SPECIFICATION

Wind powered machine

This invention provides a wind powered machine comprising:

- a housing having an inlet portion for directing into the wind, an intermediate portion of smaller cross sectional area than the inlet portion, and an outlet portion of greater cross sectional area than the intermediate portion,
- a rotor disposed within the intermediate portion of the housing to be driven in use by the air flow therethrough, and
- power take-off means coupled to the rotor.

The inlet portion preferably has an adjustable aperture for controlling the air flow through the housing.

The rotor is preferably of cylindrical form and includes a plurality of radial blades disposed at circumferential intervals.

Preferably the housing is rotatably mounted for directing into the wind.

The invention will now be exemplified with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a wind powered machine in accordance with the invention,

Figure 2 is a side view of the machine,

Figure 3 is a perspective view of the rotor included in the machine, and

Figure 4 is a transverse section through a modified rotor.

The machine comprises a base 1 rotatably mounted on a turntable 2. The base supports a housing 3 which is formed of a lightweight skin of sheet steel, aluminium, plastic or plywood supported by an external steel framework so as to present a smooth internal surface. The choice of material for the skin in any particular application depends on the size of the unit, the wind conditions in which the machine would be designed to operate, the life expected from the machine and in general the overall design specification in each instance. The housing has an inlet portion 3*a*, an intermediate portion 3*b*, and an outlet portion 3*c*.

The inlet portion 3*a* has side walls 4, 5 which converge towards the intermediate portion, and an upwardly inclined bottom wall 6. The top wall of this portion is provided by a flap 7 which is hinged adjacent to the intermediate portion by pivots 8, 9. The rear edge of the flap carries a lever arm 10 pivoted to an hydraulic or pneumatic ram 11 which is in turn pivotally coupled at 12 to the top of the housing at the junction of the intermediate and outlet portions 3*b* and 3*c*.

The side walls 13, 14 of the intermediate portion 3*b* are substantially parallel and the top wall 15 is slightly inclined downwardly towards the outlet portion. Outlet portion 3*c* has divergent side walls 16, 17, and the top and bottom walls 18, 19, also diverge. The bottom wall 19 is at a lower level than the bottom wall 6 of the inlet portion. Side walls 16, 17 are extended upwardly to form fins 20, 21.

Intermediate portion 3*b* has no bottom wall in order to accommodate a cylindrical rotor 22 (Fig. 3). The rotor inludes a central cylinder 23 to which are secured twelve circumferentially equally spaced radial blades 24 joining end cheeks 25. Together with cylinder 23 and end cheeks 25, the blades define twelve spaces which open only at the periphery of the rotor. The rotor includes a horizontal shaft 26 which projects through side walls 13, 14 and is externally journalled in bearings 27. One end of the shaft is extended beyond the bearings 27 to carry a pulley 28. This pulley is coupled by two belts 29, 30 to electric generators 31, 32 which are connected through centrifugal clutches to set to engage at preset speeds. The rotor takes up substantially the entire width of intermediate portion 3*b* and is positioned such that only its upper half is within the housing. The upwardly inclined bottom wall 6 of inlet portion 3*a* terminates on the horizontal centre line of the rotor in close proximity to the outer diameter of the rotor. There is sufficient clearance to ensure that there is no possibiltiy of contact between the rotor and the edge of bottom wall 6. This feature is an important aspect of the design as it ensures that the air stream is deflected upwards and acts rotationally on each blade in a positive direction. In a similar way the inclined bottom wall 19 of outlet portion 3*c* terminates very close to the rotor. This prevents the exhaust air from being carried round with the rotor into the lower half of the rotor chamber where it would create turbulence and thus cause drag and inefficiency.

In use, the fins 20, 21 turn the machine on turntable 2 so that the inlet portion 3*a* is always directed into the wind. Under moderate wind conditions the flap 7 is upwardly inclined away from the intermediate portion. Air entering the inlet portion is directed into the intermediate portion where its velocity and pressure increases due to the reduced cross sectional area of that portion. Air impinging on the blades of rotor 22 causes it to rotate in a clockwise direction (as viewed in the drawings) and so drive the generators 31, 32. On entering the outlet portion the air expands and its velocity again falls to that of the prevailing wind, thus avoiding turbulence at the outlet end. The external air flow around the machine tends to create a low pressure region at the outlet which draws air through the housing. The internal surface of the housing is streamlined to minimise turbulence within the housing itself.

It will be appreciated that the power take-off means (i.e. generators 31, 32) may be

duplicated on the opposite side of the machine. The generators are progressively brought into operation by the centrifugal clutches as the wind speed increases so that greater output power is produced, the increased load also serving to control the speed of the rotor.

In the fully open position as shown, the flap 7 allows the maximum volume of air to be channeled through the machine. As the wind velocity increases however, the ram 11 progressively closes the flap under microprocessor control reducing the aperture and thus the volume of air that can pass through the reduced inlet area. An increasing proportion of the air flow is thus diverted over the top of the housing. In extremely high winds the flap closes to the point where only a relatively narrow aperture exists but nevertheless allowing sufficient air to pass through the machine to provide the power output designed. This means that the machine can be used in high wind conditions where other machines would have to be shut down. Further, the flap would close off the inlet aperture altogether in dangerously high wind conditions or if the machine was required to be closed down for any other reason, e.g. maintenance or repair.

The design of rotor described above presents a large surface area to the air flow and creates a high torque. However, an even greater torque could be developed by inclining the leading edges of the blades 24 into the air flow, as illustrated in Fig. 4 with reference to a sixteen blade rotor.

In a further modification (not shown) the machine could be designed so that the rotor is mounted vertically. Hence, the rotor and power take-off means would not need to rotate with the housing.

In yet another modification (also not shown) a windmill type multibladed rotor with a high solidity ratio could be used instead of the cylindrical rotor shown. The inclined bottom walls 6, 19 of the inlet and outlet portions would be modified so that they terminate at the base of the intermediate section 3*b*. The whole cross-sectional area of the housing would form a clear duct leading to the windmill type rotor which would be installed at the point where the intermediate and outlet sections are joined. The square section of the duct would be modified to a round section to house the propeller.

Large machines could be rotated to face the prevailing wind by powered means. Also, the flap 7 could be operated by an electric geared motor in place of the ram 11.

CLAIMS

1. A wind powered machine comprising:
   - a housing having an inlet portion for directing into the wind, an intermediate portion of smaller cross sectional area than the inlet portion, and an outlet portion of greater cross sectional area than the intermediate portion,
   - a rotor disposed within the intermediate portion of the housing to be driven in use by the air flow therethrough, and
   - power take-off means coupled to the rotor.

2. A machine according to Claim 1, in which the cross sectional area of the inlet portion progressively decreases in the direction of the intermediate portion.

3. A machine according to Claim 1 or 2, in which the inlet portion has an adjustable aperture for controlling the air flow through the housing.

4. A machine according to Claim 3, in which the top wall section of the inlet portion comprises an adjustable flap for adjusting the aperture of the intermediate portion.

5. A machine according to Claim 4, in which the flap is pivoted at its edge portion most adjacent to the said intermediate portion.

6. A machine according to Claim 4 or 5, in which the flap carries a lever arm coupled to a ram for moving the flap.

7. A machine according to any of Claims 3 to 6, which includes means for automatically reducing the aperture of the inlet portion progressively as the velocity of the wind increases.

8. A machine according to any preceding claim, in which the cross sectional area of the outlet portion progressively increases in the direction of the intermediate portion.

9. A machine according to any preceding claim, in which the housing is provided with a mounting which permits the housing to be rotated for directing into the wind.

10. A machine according to Claim 9, in which the housing is provided with fins arranged to rotate the housing so that the inlet portion faces into the wind.

11. A machine according to Claim 9, including powered means for rotating the housing so that the inlet portion faces into the wind.

12. A machine according to any preceding claim, in which the rotor is of generally cylindrical form and includes a plurality of radial blades disposed at circumferential intervals.

13. A machine according to Claim 12, in which the rotor includes end cheeks to which the blades are joined.

14. A machine according to Claims 12 or 13, in which the blades extend radially from a core of generally cylindrical shape.

15. A machine according to Claim 12, 13 or 14, in which the spaces between the blades open only at the periphery of the rotor.

16. A machine according to any of Claims 12 to 15, in which the leading edges of the blades are inclined into the air flow through the housing.

17. A machine according to any of Claims 12 to 16, in which the rotor is mounted such that its axis is substantially transverse to the

housing.

18. A machine according to Claim 17, in which the rotor occupies substantially the entire width of the intermediate portion.

19. A machine according to Claim 17 or 18, in which the bottom wall section of the inlet portion terminates in close proximity to the rotor with the upper and lower portions of the rotor above and below the said wall section respectively.

20. A machine according to Claim 17, 18 or 19, in which the bottom wall section of the outlet portion terminates in close proximity to the rotor with the upper and lower portions of the rotor above and below the said wall section respectively.

21. A machine according to Claim 20 as appended to Claim 19, in which the bottom wall section of the outlet portion meets the rotor at a lower level than the bottom wall section of the inlet portion.

22. A machine according to any of Claims 12 to 16, in which the rotor is mounted substantially vertically.

23. A machine according to any preceding claim, in which the power take-off means is arranged to increase the load on the rotor as its speed increases.

24. A machine according to Claim 23, in which the power take-off means comprises electric generators connected to the rotor through centrifugal clutches arranged to engage at preset speeds.

25. A machine according to any preceding claim, in which the bottom wall section of the inlet portion is upwardly inclined towards the intermediate portion.

26. A machine according to any preceding claim, in which the side wall sections of the inlet portion converge towards the intermediate portion.

27. A machine according to any preceding claim, in which the bottom wall section of the outlet portion is downwardly inclined away from the intermediate portion.

28. A machine according to any preceding claim, in which the side wall sections of the outlet portion diverge away from the intermediate portion.

29. A machine according to any preceding claim, in which the top wall section of the intermediate portion is slightly downwardly inclined towards the outlet portion.

30. A machine according to any preceding claim, in which the side wall sections of the intermediate portion are subsequentially parallel.

31. A wind powered machine which is substantially as described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd, Dd 8991685, 1987.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.